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ACE-153

GENERAL STATEMENT ON THE PRODUCTION OF DEHYDRATED VEGETABLES

The production of dried vegetables in 1940 amounted to about 5 million pounds, of which about two-thirds consisted of powdered onions, garlic and similar flavoring vegetables which were used in secondary manufacture such as soups and sausage. The estimated production in 1941 was about 15 million pounds, most of which consisted of vegetables in such a shape that they could be rehydrated and used as a substitute for fresh vegetables.

The commonly used dehydrators are the tunnel drier, drum drier, cabinet drier and vacuum drier. Some vegetables, particularly tomatoes, have been more or less successfully dehydrated by a spray process. Both the drum type and the spray type of driers produce powder material which cannot be rehydrated to replace the fresh material because of its powdered form.

In general, the vacuum drying process requires a large amount of metal for the equipment and the output per pound of metal is low, as the process is slow.

The tunnel type is, considering its cost, probably the most satisfactory. The material to be dried is placed on trays with wire mesh or other types of ventilated bottoms, and either slid into the drier one after another, or placed upon trucks and the trucks run into the drier.

It is essential to adjust the temperature and relative humidity so as to avoid case-hardening and scorching at the beginning of the process and to reduce the temperature at the end of the process so that excessive heat will not injure the material.

Most of the commercial vegetable dehydrating firms now operating have designed and built their own dehydrators largely on a trial-and-error basis. A number of patented driers are in existance and there is attached a list of their manufacturers taken from Thomas' "Register of American Manufacturers."

The type of dehydrator used is of minor importance. The prime requisites are: Efficient control of humidity, temperature, and air velocity, and volume. Dehydrating equipment should be judged on the basis of the investment cost per ton of output of dry material, and operating costs on the same basis.

In addition to vegetables, whole and skim milk, whole eggs, fruits and meat can be dried. Except for the meat, commercial production on a large scale is now going on. A large part of the fruits, particularly those in California, are sun-dried. The balance, however, is dehydrated in some mechanical device, usually of a tunnel type.

Experimental work being carried on in the Bureau of Agricultural Chemistry and Engineering has indicated that the preliminary treatment of the vegetables prior to dehydration, particularly the blanching operation, is of very great importance in obtaining a product of satisfactory quality. The selection of suitable varieties for given localities is also of importance. There are many very acute problems connected with the packaging of the finished product in order that its storage life may be sufficiently great. The restriction, and perhaps ultimate prohibition, of the use of tin cans for this purpose necessitates the investigation of substitute containers. Satisfactory containers must be water-proof, moisture-vapor-proof and insect-proof and if not of metal must be adequately protected against puncture and leakage. Some products, particularly carrots, must be packed in nitrogen or carbon dioxide in order to retain color and vitamins.

The allocation of metals for new dehydration plants presents great difficulties to a new producer. Each case stands upon its own merits and will be decided essentially upon the necessity for dehydration of specific products in definite localities.

The production of dehydrated vegetables of a satisfactory quality is considered to be more difficult than either quick-freezing or canning. Any concern undertaking this business without skilled and experienced direction will undoubtedly suffer losses until the business is learned, and what is more important from the point of view of the welfare of the country as a whole, there will be losses of food which, under present conditions, cannot be spared.

There are in active operation about 20 commercial dehydrating concerns in this country which are engaged in the dehydration of vegetables. They have developed, through experience, their own staff of trained people and the number is exceedingly limited. Most of the production is in California, Washington and Idaho, with only comparatively small operations going on in the Eastern States. The only known sources of trained personnel for new operations are the staffs of employees of competitive producers now in the business.

In addition to the dehydration unit, there is need for machinery for washing, slicing, cutting and similar operations, inspection belts, and steam and hot water blanchers. Such equipment is generally available in canneries, expecially those which can the usual line of vegetables.

U. S. Department of Agriculture, Circular No. 619, entitled "Preservation of Fruits and Vegetables, By Commercial Dehydration", contains much valuable information. Copies should be available in the larger municipal libraries, colleges and experiment stations, or may be obtained free, as long as the supply last, from the U. S. Department of Agriculture, Washington, D. C. or from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 10 cents in coin (stamps not accepted).

If further detailed information is desired, it is suggested that inquiries be directed to E. M. Chace, Western Regional Research Laboratory, 800 Buchanan Street, Albany, California. Mr. Chace is in charge of the dehydration work now being carried on in the Bureau of Agricultural Chemistry and Engineering of the United States Department of Agriculture.

Agricultural Chemical Research Division
Bureau of Agricultural Chemistry and Engineering
U. S. Department of Agriculture
Washington, D. C.
April, 1942.

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LIST OF MANUFACTURERS OF DEHYDRATION MACHINERY TAKEN FROM THOMAS' "REGISTER OF AMERICAN MANUFACTURERS"

Chapman Dehydrator Co., Modesto, Calif.

Rees Blow Pipe Mfg. Co., 340 - 7th St., San Francisco, Calif.

Adrian Mfg. Co., San Jose, Calif.

E. H. Gautier Co., Santa Ana, Calif.

Younger Dehydrator Co., Woodland, Calif.

J. P. Divine Mfg. Co., Inc., 920 Shawnee Ave., Mt. Vernon, Ill.

Louisville Drying Machine Co., Inc., 351 Baxter Ave., Louisville, Ky.

Scott, Ernest & Co., Fall River, Mass.

Buffalo Foundry & Machine Co., 43 Winchester Ave., Buffalo, N. Y.

Proctor & Schwartz, Inc., 700 Tabor Road, Philadelphia, Pa.

Blaw-Knox Co., 2042 Farmers Bank Bldg., Pittsburgh, Pa.

Evarts G. Loomis Co., 127 S. 14th St., Newark, N. J.

Acme Industries, Inc., Jackson, Mich.

Sardik Laboratories, Inc., 305 W. 45th St., New York, N. Y.

F. J. Stokes Machine Co., 5930 Tabor Road, Olney P.O., Phaladelphia, Pa.

John B. Adt Co., 345 N. Holliday St., Baltimore, Md.
The Douthitt Corporation, 221 North LaSalle St., Chicago, Ill.

NOTE: In giving these names no guaranty is expressed or implied, nor is it to be inferred that they are recommended over others whose names are not mentioned.

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Bureau of Agricultural Chemistry and Engineering
U. S. Department of Agriculture
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UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Agricultural Chemistry and Engineering
and
Agricultural Marketing Administration

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By
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Bureau of Agricultural Chemistry and Engineering,
and
Francis L. Gerdes, Senior Cotton Technologist
Agricultural Marketing Administration

In the present war crisis, the United States Department of Agriculture includes among its aims an increase in production of long cotton fiber, cleaner seed of pure variety, and more linters. It is also seeking to serve the national interest by reducing agricultural demands upon factories having war orders, by obtaining superior ginning of all cotton, and by utilizing idle ginning facilities in whole or in part.

At the U. S. Cotton Ginning Laboratory at Stoneville, Mississippi, the joint efforts of the Bureau of Agricultural Chemistry and Engineering and the Agricultural Marketing Administration are focused upon all these objectives in their special relationship to cotton ginning methods and processes.

To plant, harvest and gin improved varieties of cotton having increased staple length over those previously grown will be the important contribution of many growers and ginners during the present emergency. It is estimated that approximately 1,400,000 bales of 1-1/8 to 1-1/4-inch cotton will be needed for mill use and carry-over in 1942-43, which is virtually twice the amount produced in 1941. Announced increases in premiums for staples 1-1/8 inches and longer should enable cotton growers to make as much per acre from these longer cottons as they would realize from higher yields of shorter cottons.

In saw-ginning as well as in roller-ginning, the findings and recommendations of the U. S. Cotton Ginning Laboratory should provide assistance of vital importance toward reaching the goals in view. This will be augmented by the regional activity of State cotton ginning specialists, county agents and other agencies.

Modernized equipment now necessarily includes driers, cleaners and extractors, gin stands running with loose seed rolls and operated with correct saw speeds, proper tooth shape, suitable pure seed handling systems and adequate pressing apparatus. All these will be required to cope with the future urgent needs. Changes in methods of harvesting which may accompany shortages of labor will also probably aggravate the ginner's problems unless he prepares himself now to meet them, and unless he can obtain the full cooperation of the producers to avoid as much rough harvesting as possible.

The benefits from drying and conditioning tend to become greater as longer cottons are ginned. The Laboratory advocates taking every measure to assure at least a minimum of drying. This may be accomplished by supplying heated air to overhead cleaners and extractors to make them more efficient. Where it is still feasible to do so, the Laboratory urges steps to obtain the maximum benefits which arise from complete driers. This is especially important to increase the efficiency of cleaning and extracting processes in the ginning operation, because it is conducive to superior ginning and is essential as a first step toward procuring clean seed and resulting clean linters. It may, in fact, be one of the two most important stages in ginning during which foreign matter may be removed once and for all from the seed. It is said that in the delicate processes of making explosives, small hard particles of gin trash which are carried along with the linters, may in the final stages of manufacture, detonate the materials and thereby wreck the entire factory.

It is probable that after the factory supply of driers now in stock has been depleted, ginners may be faced with devising their own driers from non-metalic materials plus a limited amount of black sheet metal. Black iron with plywood or plain lumber has already given several years of service in some vertical driers. Sources of heat, likewise, may be ingeniously constructed by converting old boilers into furnaces, or by combining used boiler tubes with suitable brick-work, or by utilizing different kinds of discarded heaters.

To minimize the demands upon ginning manufacturers whose defense orders already consume much of their capacity, is a national necessity. The modernization and repair of existing equipment in an economical manner is a service of great value in which ginning machinery salesmen may find broad opportunities. They may assist their patrons to overhaul old cleaners and extractors so as to produce satisfactory service without requiring new machines. They may help their customers to undertake the gin-stand modernizations which the U. S. Cotton Ginning Laboratory advocates. This involves relatively small outlays in funds and supplies, and steps up the speed of the saw cylinders to 650 or 700 revolutions per minute, along with internal improvements in the stands which assure additional years of life and good ginning. Fortunately, most of the items needed for such modernization are still available through the supply houses and gin manufacturing plants.

To further lessen the demands upon manufacturers, it is advisable for ginners to protect all spare pieces of equipment about their gins - or to pool them for community trade or sale. Many gins have discarded fans, separators, cleaners, pump parts, condenser drums, spare piping and millwright items which can retain much usefulness if they are not allowed to disintegrate in the weather. Preservation of bearings, pieces of shafting, pulley and coupling parts, bushings, and short sections of rubber belting may prove wise. Cast iron and steel fan scrolls are more valuable for repairs than for junk, and these can often be relined with old belting or so cemented - sometimes with portland cement and sand - as to remain serviceable.

In respect to pressing equipment, steel bindings for wooden presses are obtainable, but new all-steel press outfits are almost out of the picture because of priority restrictions. Now is the time to guarantee continued years of service to the press by getting repair parts, ram packing, pump parts and tramper replacement items.

Purity of seed can be quite easily assured at most gins, even where a seed augur is now used to convey seed to a blow-plug or vacuum wheel. Replacement of the augur with a self-cleaning seed-belt running at a surface speed of about 200 feet per minute is one way to do this. In the belt method, a vacuum wheel must replace any seed-plug, but the changeover is not difficult. There are also other satisfactory methods for assuring purity of seed. Among the more recently developed self-cleaning systems for maintaining pure seed, the U. S. Cotton Ginning Laboratory has devised a suction separator of special proportions which is mounted upon a No. 35 gin fan in a compact and simple manner for dust-proof and trouble-proof handling of the ginned seed. It can be made by the ginner. It draws the seed from the end of the self-cleaning seed belt through a suction funnel, and thence blows it from the vacuum wheel of the separator to the sacker or seed bin.

The superior ginning of longer staple upland cottons requires care on the part of both farmer and ginner. The condition in which the farmer brings his seed cotton to the gin is one of the most important factors upon which grade of lint and quality of seed depend, and the grower should remember the following points:

1. Excess foreign matter and moisture in the seed cotton reduce the value of the ginned lint and seed and under many conditions retard ginning operations and produce excess wear and tear on machinery.

2. Undue exposure in the field produces discolored, dull, trashy cotton which is generally one full grade off for each month's exposure. To avoid losses and improve the ginning, cotton should be picked frequently but not in an extremely wet condition.

3. Ginning cotton in a green, damp or wet condition causes rough preparation and lower quality by as much as one or two grades. This may drop the market value of long staple cotton as much as $10 or more a bale. When dews are heavy, seed cotton will generally be too damp for good ginning if picked before 9 or 10 o'clock in the morning. Drying of these pickings during the day, only for as long as necessary to remove excess moisture, improves ginning. If cotton is picked while damp it can be artificially dried at many gins, or it can be dried naturally through proper handling and storing, provided it is not so wet that the seed are soft.

4. Gin machinery is definitely limited in its effectiveness when handling carelessly harvested cottons. Present-day drying, cleaning and extracting machinery is remarkably efficient, but it is not effective enough to put roughly harvested, trashy or wet cotton in such condition that it will gin out a sample equal in quality to that ginned from clean cotton picked by hand under relatively dry conditions.

The ginner, on his part, begins his processes with a necessity for adequate dryness in the seed cotton so that he may properly perform the cleaning and extracting stages of his work before he feeds the cotton into the gin stands. Artificial drying of green or damp seed cotton will thus materially improve the grade of the ginned lint and the storage properties of the seed, and it will also make for cleaner seed cotton and cleaner seed for linters.

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It is highly advisable that cotton gins possess adequate extracting equipment such as the individual extractor-feeders now widely used in the cotton belt in lieu of older model big drum or small drum feeders. These are essential to grade improvements in trashy or weather damaged cotton.

In the gin stand operation, loose roll ginning with good saws, good ribs and doffing will play a most important role. The saw teeth must be of correct shape and pitch, the ribs properly spaced and in good condition, and the airblast nozzles or brush cylinders in first-class condition and setting. With full diameter good saws running at from 650 to 700 revolutions per minute, and other elements in good shape as above stated, the seed can be well cleaned even with very loose seed rolls, and the ginned lint can be smoothly produced. Frequent classification and examination of samples will return good dividends to producers and ginners in helping to keep up the quality and eliminating faulty harvesting and handling practices or ginning methods, which otherwise could not be promptly corrected.

The second important phase in the ginners' problem of keeping gin-run seed clean in order that the mills may produce higher grade linters will be greatly simplified if ginners will take steps to prevent the return of any trash or motes to the seed during its several handlings, and if he will avoid tight roll ginning in which fragments of hard seed coat are often chipped off the seed.

Seed-blowing with the suction-fan exhaust is clearly now against the public interest because it continually contaminates the seed with dirt and trash which is difficult to remove at the mill. Self-cleaning, pure seed systems should be used.

It is expected that some inactive gins will be closed out for good so that their millwright, press and power elements may be used elsewhere for baling wool or other materials, and so that their equipment may be suitably disposed of to best advantage.

As to how, in these war times, a ginner may employ his ginning plant to play an additional part in the war effort over and above the vital responsibilities which he has in performing better ginning than he ever has done before, is a problem. It takes the three special "M's" of management, men, and machines to execute any kind of war sub-contracts, and much imagination and individual ingenuity is needed if a ginner is to keep his gin busy in the usual idle season by extending to war work.

Consequently, better ginning still remains the principal objective of all patriotic ginners. They may expect that rubber, metal, bearings, quality lubricants, repairs and replacement parts will all be increasingly restricted as the war lengthens. But early repairs are urgent, modernization must be done now, and the needs of the coming season should be prepared for at once, if the ginner is to go shoulder to shoulder through this crisis with his farmer customers, so that they may benefit both their country and themselves.